

Cane Creek Embayment Pickwick Reservoir Intensive Basin Survey 2015

PICL-3: Cane Creek approx 1 mi upstream of confluence with TN River (Colbert Co 34.74694/-87.86389)

BACKGROUND

The Alabama Department of Environmental Management (ADEM) began monitoring lake water quality statewide in 1985, followed by a second statewide survey in 1989. In 1990, the Reservoir Water Quality Monitoring Program [now known as the Rivers and Reservoirs Monitoring Program (RRMP)] was initiated by ADEM.

The current objectives of this program are to provide data that can be used to assess current water quality conditions, identify trends in water quality conditions and to develop Total Maximum Daily Loads (TMDLs) and water quality criteria. Descriptions of all RRMP monitoring activities are available in ADEM’s 2012 Monitoring Strategy (ADEM 2012).

In 2015, ADEM monitored the Cane Creek tributary embayment of Pickwick Reservoir as part of the basin assessment of the Tennessee River under the RRMP. This site was selected using historical data and previous assessments. The purpose of this report is to summarize data collected in the Cane Creek embayment (PICL-3) during the 2015 growing season (Apr-Oct). This is the fourth basin assessment of the Tennessee River since ADEM began sampling embayment stations. Monthly and/or mean concentrations of algal biomass/productivity [chlorophyll *a* (chl *a*)], sediment [total suspended solids (TSS)], and trophic state [Carlson’s trophic state index (TSI)] from 2015 were compared to ADEM’s previous data and established criteria.



Figure 1. Photo of Cane Creek at PICL-3

WATERSHED CHARACTERISTICS

Watershed land uses are summarized in Table 1. Cane Creek is classified as a *Fish & Wildlife (F&W)* stream located in the Eastern Highland Rim ecoregion (71g). Based on the 2006 National Land Cover Dataset, land use within the 59 mi² watershed is predominantly forest (57%) (Fig. 3). As of January 28, 2016, ADEM has issued a total of 11 NPDES permits within the watershed. Five of those permits are located within 10 mi of the station (Fig. 2).

SITE DESCRIPTION

The Cane Creek embayment at PICL-3 is located just west of Colbert Steam Plant. It is a fairly shallow embayment with a mean bottom depth of 2.3 m (Table 2) at the sampling location and has a moderate to swift flow for much of the sampling season.

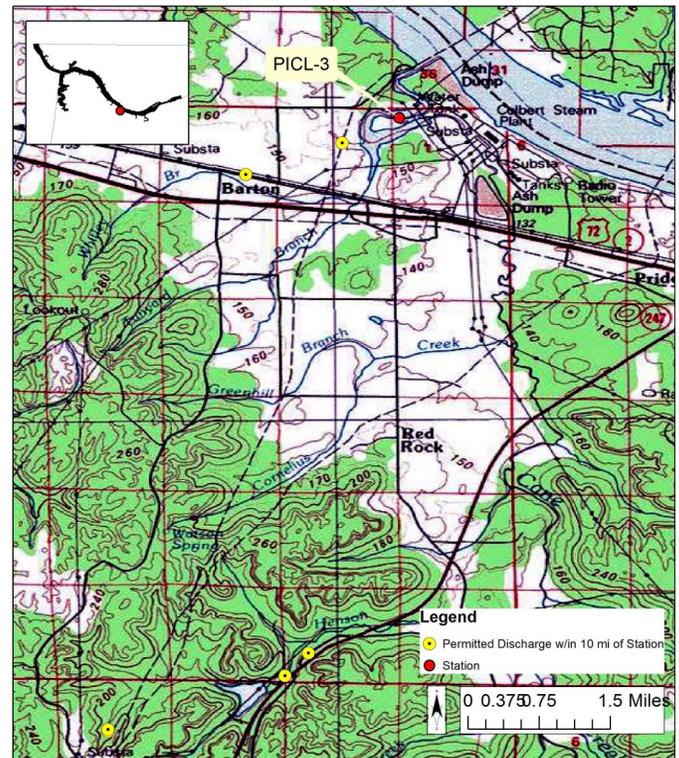


Figure 2. Map of Cane Creek Embayment of Pickwick Reservoir. Though additional permitted facilities may occur in the watershed (Table 1), only those discharges within 10 miles upstream of the station are displayed on the map.

METHODS

Water quality assessments were conducted at monthly intervals, April-October. All samples were collected, preserved, stored, and transported according to procedures in the ADEM Field Operations Division Standard Operating Procedures (ADEM 2015), Surface Water Quality Assurance Project Plan (ADEM 2012), and Quality Management Plan (ADEM 2013).

Mean growing season TN, TP, chl *a*, and TSS were calculated to evaluate water quality conditions. Monthly concentrations of these parameters were graphed with ADEM's previously collected data to help interpret the 2015 results. Carlson's TSI was calculated from the corrected chl *a* concentrations.

RESULTS

The following discussion of results is limited to those parameters which directly affect trophic status or parameters which have established criteria. Results of all water chemistry analyses are presented in Table 2. The axis ranges of the graphs in Figs. 4-6 were set to maximum values reservoir-wide so all embayment reports on the same reservoir could be compared.

Table 1: Summary of Watershed PICL-3

Basin		Tennessee R
Drainage Area (mi ²)		59
Ecoregion ^a		71g
% Land use		
Open Water		1%
Developed	Open Space	3%
	Low Intensity	1%
	Medium Intensity	<1%
	High Intensity	<1%
Barren Land		<1%
Forest	Deciduous Forest	48%
	Evergreen Forest	5%
	Mixed Forest	4%
Shrub/Scrub		15%
Herbaceous		6%
Hay/Pasture		12%
Cultivated Crops		4%
Woody Wetlands		2%
# NPDES Permits ^b		TOTAL
Construction Stormwater		3
Mining		1
Small Mining		0
Industrial General		6
Industrial Individual		1
No Exposure		0
Municipal		0
Underground Injection Control		0

a. Eastern Highland Rim

b. #NPDES outfalls downloaded from ADEM's NPDES Management System database, Jan 28, 2016.

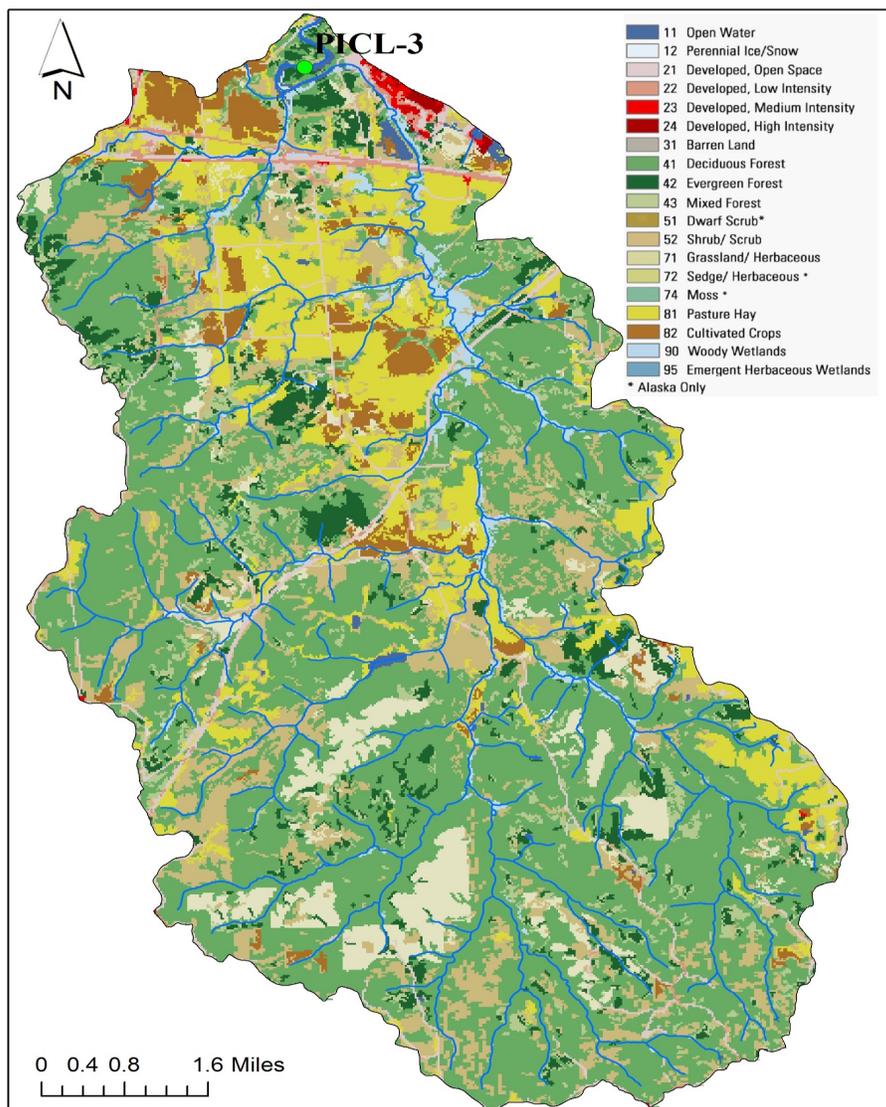


Figure 3. Land use within the Cane Creek watershed at PICL-3.

The mean growing season TN value was higher in 2015 than in any prior year (Fig. 4). Monthly TN concentrations were highest in September and variable month to month.

Mean growing season TP concentration was lower in 2015 compared to any previous sampling years (Fig. 4). The highest monthly TP concentration was reached in October.

In 2015, the growing season mean chl *a* value was lower compared to 2003-2013 (Fig. 4). Monthly chl *a* concentrations were generally low April-June then increased during the warmer months. Highest monthly chl *a* concentration occurred in September.

Mean TSI was mesotrophic in 2015 (Fig. 4). Monthly TSI values were mesotrophic or lower much of the growing season, however, a eutrophic value was reached in September.

The mean growing season TSS concentration was lower in 2015 than in any prior year (Fig. 4). Monthly TSS concentration was highest in May.

The DO concentration in the PICL-3 was below the ADEM criteria limit of 5.0 mg/l at 5.0 ft (1.5 m) in August and near the limit in June (ADEM Admin. Code R. 335-6-10-.09) (Fig. 5).

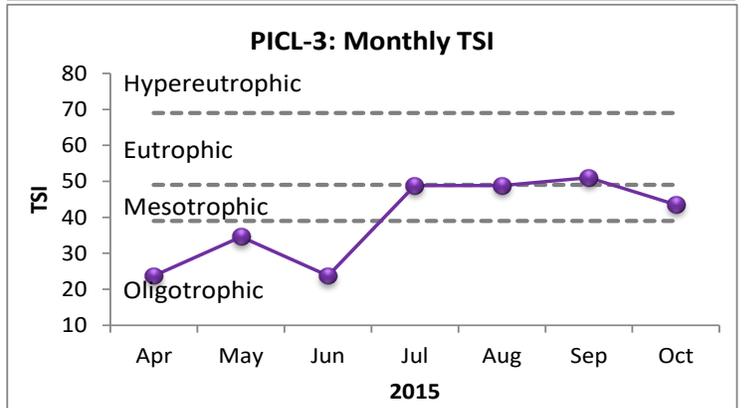
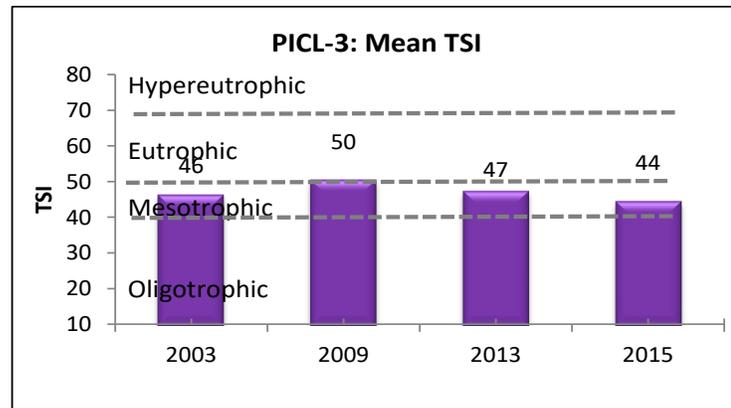
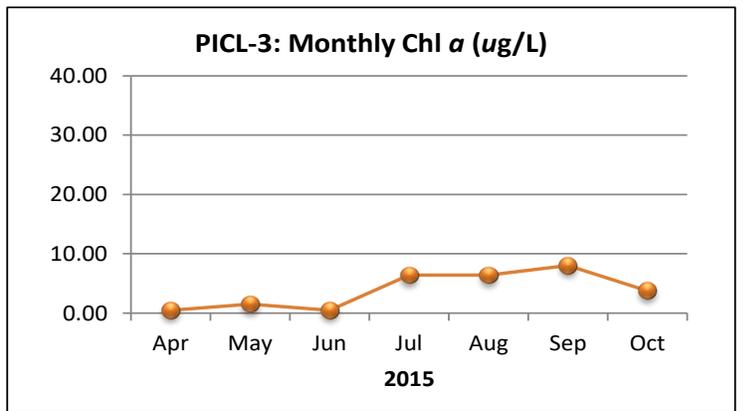
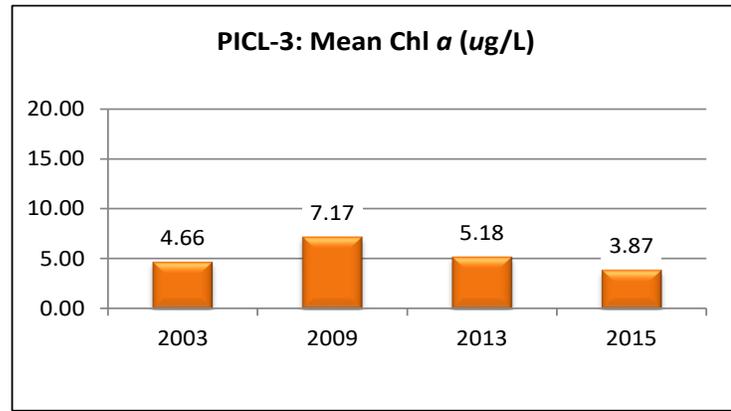
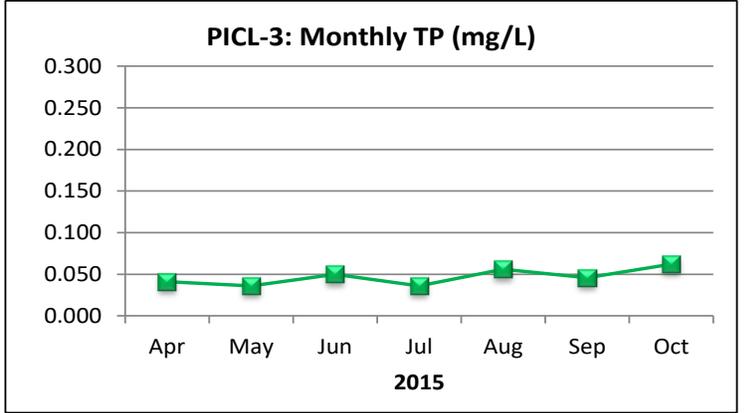
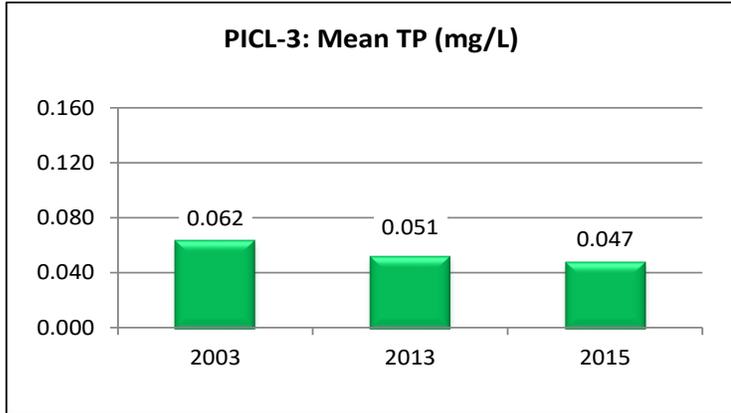
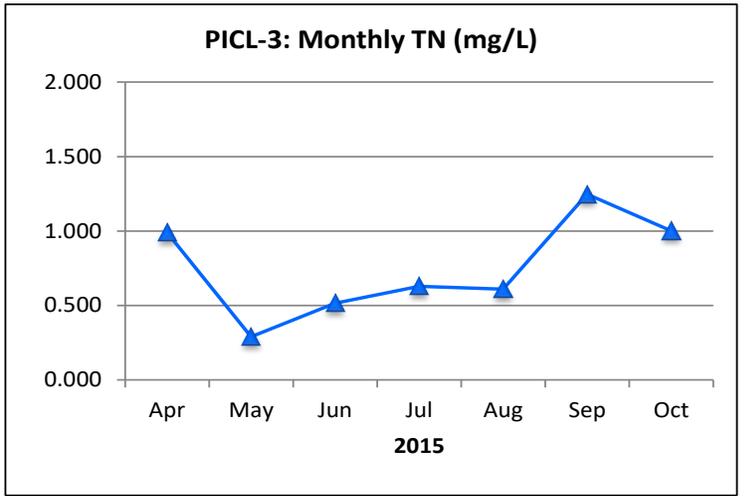
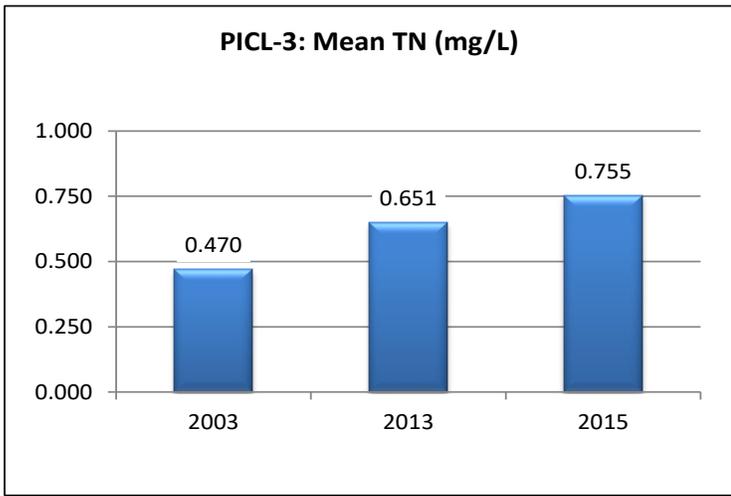


Figure 4. Mean growing season (2003-2015) and monthly (April-October, 2015) chl *a*, TSI, and TSS measured in the Cane Creek embayment of Pickwick Reservoir. Vertical axis ranges are set to maximum values reservoir-wide for comparability between embayment reports within the same reservoir. 2009 mean TN and mean TP data did not meet ADEM QA standards and are not included.

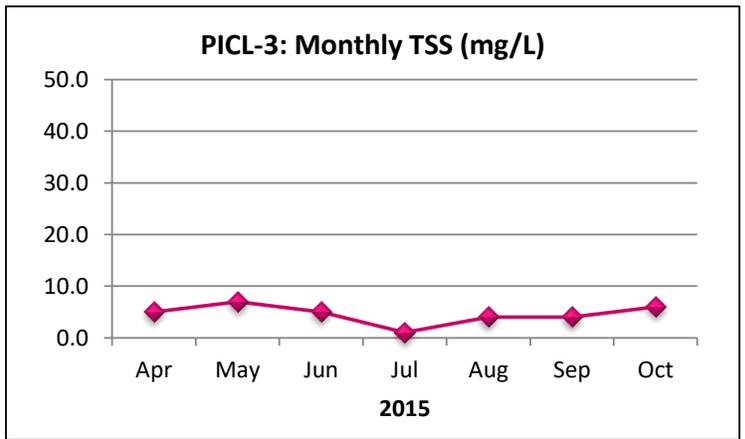
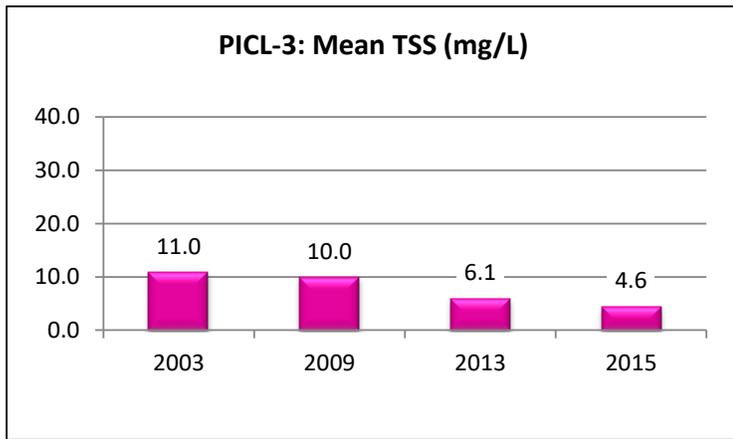


Figure 5. Mean growing season and monthly TSS measured in the Cane Creek embayment of Pickwick Reservoir.

Table 2. Summary of water quality data collected April-October, 2015. Minimum (Min) and maximum (Max) values calculated using minimum detection limits. Median (Med), Mean, and standard deviations (SD) values were calculated by multiplying the MDL by 0.5 when results were less than this value.

PICL-3	N	Min	Max	Med	Mean	SD
Physical						
Turbidity (NTU)	7	3.3	14.5	4.3	5.9	4.0
Total Dissolved Solids (mg/L)	7	74.0	137.0	104.0	106.4	19.5
Total Suspended Solids (mg/L)	7	1.0	7.0	5.0	4.6	1.9
Hardness (mg/L)	4	66.6	86.5	82.2	79.4	9.0
Alkalinity (mg/L)	7	60.7	78.3	72.5	71.0	5.6
Photic Zone (m)	7	1.80	3.00	2.30	2.34	0.40
Secchi (m)	6	1.19	2.10	1.66	1.63	0.33
Bottom Depth (m)	7	1.8	3.0	2.3	2.3	0.4
Chemical						
Ammonia Nitrogen (mg/L)	7	< 0.007	0.213	0.020	0.044	0.076
Nitrate+Nitrite Nitrogen (mg/L)	7	0.129	0.397	0.258	0.237	0.100
Total Kjeldahl Nitrogen (mg/L)	7	< 0.064	1.100	0.500	0.518	0.341
Total Nitrogen (mg/L)	7	< 0.290	1.247	0.629	0.755	0.334
Dis Reactive Phosphorus (mg/L)	7	0.022	0.047	0.031	0.032	0.011
Total Phosphorus (mg/L)	7	0.036	0.062	0.046	0.047	0.010
CBOD-5 (mg/L) ^J	7	< 2.0	2.0	1.0	1.0	0.0
Chlorides (mg/L)	7	5.5	9.9	7.9	7.9	1.4
Biological						
Chlorophyll a (mg/m ³)	7	< 1.00	8.01	3.74	3.87	3.12
E. coli (MPN/DL) ^J	3	4	276	12	97	154

J= one or more of the values is an estimate; N= # samples.

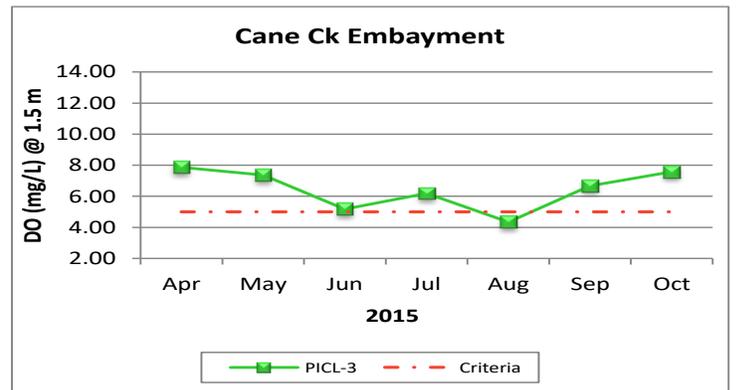


Figure 5. Monthly DO concentrations at 1.5 m (5 ft) or mid depth for Cane Creek embayment station of Pickwick Reservoir collected April-October 2015. ADEM Water Quality Criteria pertaining to reservoir waters require a DO concentration of 5.0 mg/L at this depth.

REFERENCES

- ADEM. 2015. Standard Operating Procedures Series #2000, Alabama Department of Environmental Management (ADEM), Montgomery, AL.
- ADEM. 2013. Quality Management Plan (QMP) for the Alabama Department of Environmental, Alabama Department of Environmental Management (ADEM), Montgomery, AL. 58 pp.
- ADEM. 2012. Quality Assurance Project Plan (QAPP) for Surface Water Quality Monitoring in Alabama. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 78 pp.
- ADEM. 2012. State of Alabama Water Quality Monitoring Strategy June 19, 2012. Alabama Department of Environmental Management (ADEM), Montgomery, AL. 88 pp. <http://www.adem.alabama.gov/programs/water/wqsurvey/2012WQMonitoringStrategy>
- Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.09). 2010. Specific Water Quality Criteria. Water Quality Program. Chapter 10. Volume 1. Division 335-6.
- Alabama Department of Environmental Management Water Division (ADEM Admin. Code R. 335-6-10-.11). 2010. Water Quality Criteria Applicable to Specific Lakes. Water Quality Program. Chapter 10. Volume 1. Division 335-6.
- Carlson, R.E. 1977. A trophic state index. *Limnology and Oceanography*. 22(2):361-369.
- Raschke, R.L. and D.A. Schultz. 1987. The use of the algal growth potential test for data assessment. *Journal of Water Pollution Control Federation* 59(4):222-227.

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